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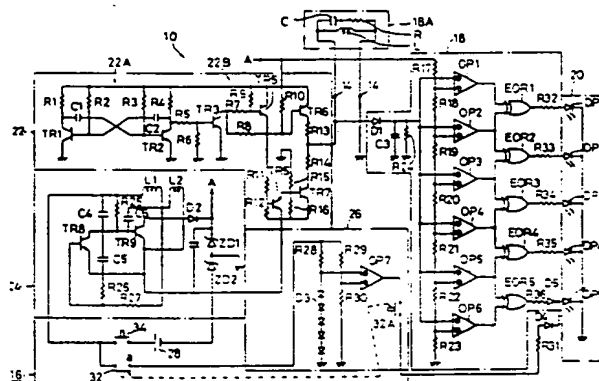
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54 APPARATUS FOR DETECTING A FERTILIZABLE PERIOD OF MAMMALS.

57 An apparatus for detecting a fertilizable period of mammals wherein electrodes (14, 14) are pressed onto the mucous membrane of vagina of a mammal to detect the concentration of sodium ions in the mucous membrane of vagina on the basis of the impedance between the electrodes (14, 14), and the result of detection is indicated on an indication means (20). When the concentration of sodium ions in the mucous membrane of vagina is nearly equal to that of water, it is indicated that ovulation will take place soon.



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DESCRIPTION

FERTILIZABILITY DETECTING APPARATUS FOR MAMMALS

TECHNICAL FIELD

The present invention relates to a fertilizability detecting apparatus for detecting the fertilizability of mammals including men.

BACKGROUND ART

Fertilizability or ovulation detecting apparatus which detect the fertilizability or ovulation of mammals on the basis of the equivalent DC resistance on the mammal's vaginal mucous membrane have been proposed. for example, in Japanese Patent Laid-open (Kokai) Nos. 60-188142 through 188148, 60-190942, 60-190943, 60-190944, 60-220052, 60-227746, 61-90651 through 90655, 61-137543, 61-137544, 61-187545, 61-137554 and 61-217157. These apparatus detect the sodium ion concentration on the mammal's vaginal mucous membrane on the basis of the equivalent DC resistance which varies in inverse proportion to the sodium ion concentration.

Each foregoing known ovulation predicting apparatus or fertilizability detecting apparatus is designed on the basis of an empirical rule that the equivalent DC resistance on the vaginal mucous membrane increases to a maximum level just before ovulation, and is provided with lamps respectively corresponding to the maximum level, the minimum level and a plurality of levels between the maximum and minimum levels of equivalent DC resistance. Each lamp lights up when the equivalent DC resistance on the vaginal mucous membrane coincides with the corresponding level of equivalent DC resistance.

With hogs, for instance, it is generally accepted that insemination is achieved successfully at a maximum conception ratio when the chilled semen or the live semen

1 is introduced into the uterus five to seven hours before
ovulation and when the frozen semen is introduced into the
uterus two hours before ovulation.

5 Accordingly, it is most desirable to light up the lamp
corresponding to a detected equivalent DC resistance on
the vaginal mucous membrane when the detected equivalent
DC resistance corresponds to an equivalent DC resistance
10 in a period five to seven hours before or two hours before
ovulation.

However, the maximum equivalent DC resistance on the
vaginal mucous membrane, which is reached just before
ovulation, and the minimum equivalent DC resistance, which
15 is reached in an unfertilizable period, namely, a period
in which ovulation does not occur, have not been known so
far. Accordingly, the lamp corresponding to an equivalent
DC resistance representing vaginal conditions suitable for
insemination of the known ovulation predicting apparatus
20 or fertilizability detecting apparatus does not
necessarily indicate an accurate period suitable for
depositing the semen in the uterus.

Therefore, artificial insemination has not successfully
25 been achieved at a conception ratio of 100% even if
artificial insemination was carried out in an appropriate
inseminating period determined by the ovulation predicting
apparatus or the fertilizability detecting apparatus.
Furthermore, it has been impossible to use the
30 fertilizability detecting apparatus for man for the
purpose of birth control, because the minimum DC
resistance on the vaginal mucous membrane, namely, a
criterion for zero point setting, is indefinite.

35 With the foregoing in view, it is an object of the present
invention to provide a fertilizability detecting apparatus
for mammals, capable of exactly determining the
fertilizable state of mammals, capable of setting an

1 accurate zero point, and capable of ensuring substantially
100% successful insemination.

It is another object of the present invention to provide a
5 fertilizability detecting apparatus applicable to birth
control.

DISCLOSURE OF THE INVENTION

The present invention has been made on the basis of
10 findings that the sodium ion concentration on the vaginal
mucous membrane reaches a minimum sodium ion concentration
approximately corresponding to that of water during
ovulation and reaches a maximum sodium ion concentration
approximately corresponding to the sodium ion
15 concentration of the blood of the mammal during an
unfertilizable period, and that, although it has been
supposed that the sodium ion concentration varies in
inverse proportion to the equivalent DC resistance on the
vaginal mucous membrane, the sodium ion concentration
20 varies in inverse proportion to the equivalent impedance
on the vaginal mucous membrane.

To achieve the foregoing object, the present invention
provides a fertilizability detecting apparatus for
25 mammals, comprising: sodium ion concentration detecting
means for detecting the sodium ion concentration on the
mammal's vaginal mucous membrane; and fertilizability
indicating means for indicating a suitable inseminating
period where a detected sodium ion concentration
30 corresponds to a minimum sodium ion concentration
substantially equal to that of water, which is reached
just before ovulation.

The sodium ion concentration detecting means comprises: a
35 detecting unit which is inserted in the mammal's vagina; a
plurality of electrodes arranged on the detecting unit so
as to be in contact with the vaginal mucous membrane when
the detecting unit is inserted in the vagina; voltage

1 generating means for applying a voltage across the
plurality of electrodes; and an impedance detector for
detecting the impedance between the electrodes. The
indicating means indicates a period before ovulation
5 suitable for depositing the semen in the uterus when a
detected equivalent impedance on the vaginal mucous
membrane detected by the impedance detector corresponds to
an equivalent impedance on the vaginal mucous membrane
before ovulation, on the basis of a maximum impedance
10 between the electrodes on the vaginal mucous membrane
substantially the same as that of water.

In another aspect of the present invention, a
fertilizability detecting apparatus for mammals comprises:
15 sodium ion concentration detecting means for detecting the
sodium ion concentration on the vaginal mucous membrane;
and indicating means which indicates a period where a
detected sodium ion concentration detected by the sodium
ion concentration detecting means coincides with a maximum
20 sodium ion concentration which is reached during an
unfertilizable period and substantially corresponds to the
sodium ion concentration of the blood of the mammal.

The sodium ion concentration detecting means comprises: a
25 detecting unit which is inserted in the mammal's vagina; a
plurality of electrodes arranged on the detecting unit so
as to be in contact with the vaginal mucous membrane when
the detecting unit is inserted in the vagina; voltage
generating means for applying a voltage across the
30 plurality of electrodes; and an impedance detecting unit
for detecting the impedance between the electrodes. The
indicating means indicates a fertilizable period when a
detected equivalent impedance on the vaginal mucous
membrane detected by the impedance detecting unit is
35 substantially equal to a minimum equivalent impedance
representing an unfertilizable state of the mammal, which
is substantially equal to the equivalent impedance of the
blood of the mammal.

1 In a further aspect of the present invention, a
fertilizability detecting apparatus for mammals comprises:
sodium ion concentration detecting means for detecting the
sodium ion concentration on the mammal's vaginal mucous
5 membrane; and indicating means which indicates a
fertilizable period where a detected sodium ion
concentration detected by the sodium ion concentration
detecting means corresponds to a sodium ion concentration
representing an unfertilizable period, determined on the
10 basis of a minimum sodium ion concentration substantially
equal to that of water which is reached just before
ovulation, and a maximum sodium ion concentration
substantially equal to the sodium ion concentration of the
blood of the mammal which is reached in an unfertilizable
15 period.

The sodium ion concentration detecting means comprises: a
detecting unit which is inserted in the vagina of the
mammal; a plurality of electrodes arranged on the
20 detecting unit so as to be in contact with the vaginal
mucous membrane when the detecting unit is inserted in the
vagina of the mammal; a voltage generating means for
applying a voltage across the plurality of electrodes; and
impedance detecting means for detecting the impedance
25 between the electrodes. The indicating means indicates an
unfertilizable period where a detected equivalent
impedance of the vaginal mucous membrane detected by the
detecting unit coincides with an equivalent impedance
representing an unfertilizable period which is determined
30 on the basis of a maximum equivalent impedance
substantially equal to that of water which is reached just
before ovulation, and a minimum equivalent impedance
substantially equal to that of the mammal's blood which is
reached in an unfertilizable period.

35

The present invention is based on a fact that the sodium
ion concentration on the vaginal mucous membrane is
reaches a minimum sodium ion concentration substantially

1 the same as that of water just before ovulation, and the
indicating means indicates a period suitable for
introducing the semen into the uterus before ovulation on
the basis of the minimum sodium ion concentration.
5 Accordingly, a period of ovulation and a fertilizable
period determined on the basis of the moment of ovulation
can accurately be detected.

Furthermore, since the indicating means of the present
10 invention is designed so as to indicate an unfertilizable
period on the basis of a fact that the sodium ion
concentration on the mammal's vaginal mucous membrane
reaches a maximum sodium ion concentration, which is
substantially equal to the sodium ion concentration of the
15 blood of the mammal, during an unfertilizable period, the
zero point of the indicating means can accurately be set.
Accordingly, the unfertilizability detecting apparatus of
the present invention is applicable to birth control.

20 BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a front elevation of a fertilizability
detecting apparatus for mammals, in a preferred
embodiment, according to the present invention:

25 Figure 2 is an electric circuit diagram of the electrical
construction of the fertilizability detecting apparatus of
Fig. 1;

Figure 3 is a block diagram of the fertilizability
30 detecting apparatus of Fig. 1;

Figure 4 is a graph showing the variation of the impedance
on the hog's vaginal mucous membrane with time; and

35 Figure 5 is a front elevation of a fertilizability
detecting apparatus, in another embodiment, according to
the present invention.

BEST MODE FOR CARRYING OUT THE INVENTION

The preferred embodiments of the present invention will be described hereinafter with reference to the accompanying drawings.

Referring to the drawings, a fertilizability detecting apparatus in a first embodiment according to the present invention comprises: a bar-shaped detecting unit 12; a sodium ion concentration detecting unit 10 comprising a pair of electrodes 14 arranged on the extremity 12A of the detecting unit 12 so as to be in contact with the mammal's vaginal mucous membrane, a voltage generating unit 16 for applying a voltage across the electrodes 14, and a level decision unit 18 for detecting the impedance between the electrodes 14, and an indicating unit 20 which indicates an appropriate semen deposition period before ovulation, and an unfertilizable period in which ovulation does not occur on the basis of a maximum equivalent impedance on the vaginal mucous membrane substantially equal to that of water, which is reached just before ovulation, and a minimum equivalent impedance on the mammal's vaginal mucous membrane substantially equal to that of the blood of the mammal.

The voltage generating unit 16 has an ac power generator 22, a boosting transformer 24, and a voltage comparator 26.

The ac power generating unit 22 includes an astable multivibrator 22A and a positive-negative pulse amplifier 22B.

The astable multivibrator 22A comprises, as principal components, transistors TR1 and TR2, resistors R1 to R4, and capacitors C1 and C2. The positive-negative amplifier 22B has transistors TR3 to TR7 and resistors R5 to R16 for amplifying pulses provided by the astable multivibrator 22A.

1 The boosting transformer 24 comprises an inverter circuit
for raising the output voltage of a power battery 28 to a
necessary voltage, comprising amplifying transistors TR8
and TR9, capacitors C4 to C7 to apply the output voltage
5 of the power battery 28 to the transistors TR8 and TR9 for
raising the output voltage of the power battery 28,
resistors R25 to R27, coils L1 and L2, a diode D2, and a
Zener diodes ZD1 and ZD2. The respective positive
terminals of the diode D2 and the Zener diode ZD1 are
10 connected to the resistor R10 of the ac generating unit 22
and to the resistor R17 of the level decision unit 30 to
receive an increased voltage and a current.

The level decision unit 18 has a plurality of voltage
15 comparators for detecting the impedance level of an
impedance equivalent circuit 18A of an objective (the
vaginal mucous membrane) by means of an ac voltage applied
across the electrodes 14. The indicating unit 20 has
light emitting diodes DP1 to DP5 respectively
20 corresponding to impedance levels determined by the level
decision unit 18 to indicate the corresponding impedance
levels.

The level decision unit 18 comprises: resistors R17 to
25 R23 for dividing a voltage applied thereto by the boosting
transformer 24; operational amplifiers OP1 to OP6 for
comparing the divided voltages with a voltage signal
developed across the electrodes 14 and provided through
the diode D1; and exclusive OR circuits EOR1 to EOR5 to
30 generate light emitting diode driving signals for driving
the light emitting diodes DP1 to DP5 of the indicating
unit 20 on the basis of the output signals of the
operational amplifiers OP1 to OP6. The level decision
unit 18 decides the impedance level of the impedance
35 equivalent circuit 18A on the basis of the voltage signal
provided through the diode D1. Elements including a
capacitor C3 and a resistor R24 are connected to the
positive terminal of the diode D1 to stabilize the input

1 voltage signal given to the operational amplifiers OP1 to
OP6.

The voltage comparator 26 is used for checking the output
5 voltage of the power battery 28. An operating switch 32
is closed to actuate the voltage comparator 26.

In Fig. 2, indicated at 34 is an operating switch for
actuating the level decision unit 18.

10 The voltage comparator 26 has resistors R28 to R30, a
series arrangement D3 of diodes, resistors R28 to R30, and
an operational amplifier OP7 for comparing the voltage
divided by the series arrangement D3 of diodes. A
15 decision signal representing the result of comparative
check is give through a contact 32A interlocked with the
operating switch 32 for simultaneous operation to the
light emitting diode DP5 to drive the light emitting diode
DP5 according to the decision signal. The output signal
20 of the operational amplifier OP7 is given through a
resistor 31 and a diode D4 to the light emitting diode D5.
A diode D5 is provided between the diode D4 and the
exclusive OR circuit EOR5 to prevent the backward
application of the decision signal t the exclusive OR
25 circuit EOR5. Voltage dividing resitors R32 to R36 are
connected respectively to the output terminals of the
exclusive OR circuits EOR1 to EOR5 to divide the driving
signals applied respectively to the light emitting diodes
DP1 to DP5.

30 The sum of the resistances of the voltage dividing
resistors R18 to R23 is slightly smaller than the
impedance of water. The hog's normal body temperature,
for instance, is 38.5° C. Accordingly, the sum of the
35 resistances of the resistors R18 to R23 is on the order of
2.14 k Ω at 38.5° C, which is slightly smaller than the
equivalent impedance of water across the electrodes 14
(hereinafter an impedance across the electrodes 14 will be

1 referred to simply as "impedance").

Ordinarily, a man drinks city water and well water, which are different from each other in equivalent impedance.

5 Accordingly, the sum of the resistances of the voltage dividing resistors R18 to R23 is decided roughly.

Concretely, the sum of the resistances of the resistors R18 to R23 is decided so that the light emitting diode DP1 lights up when the electrodes 14 are immersed in city
10 water.

The resistance of the voltage dividing resistor R23 is substantially the same as the equivalent impedance of the blood of the objective mammal, which is, for example, a
15 value on the order of 0.78 k Ω for the hog. Concretely, the resistance of the voltage dividing resistor R23 is decided so that the light emitting diode DP5 lights up when the electrodes 14 are immersed in the blood.

20 The sum of the resistances of the voltage dividing resistors R19 to R23 is substantially the same as the equivalent impedance on the mammal's vaginal mucous membrane at an appropriate period for depositing the chilled semen in the uterus, which is, for example, a
25 value on the order of 1.88 k Ω for the hog.

The sum of the resistances voltage dividing resistors R20 to R23 is substantially the same as the equivalent impedance on the mammal's vaginal mucous membrane at an
30 appropriate period for depositing the frozen semen in the uterus of the mammal, which is, for example a value on the order of 1.644 k Ω for the hog.

The sum of the resistances of the voltage dividing
35 resistors R21 to R23 is substantially the same as the maximum equivalent impedance on the mammal's vaginal mucous membrane during an unfertilizable period in which ovulation does not occur, which is, for example, 1.00 k Ω

1 for the hog.

The sum of the resistances of the voltage dividing resistors R22 and R23 is substantially the same as the
5 lower half of the equivalent impedance on the mammal's vaginal mucous membrane during an unfertilizable period of the mammal in which ovulation does not occur, which is, for example, a value on the order of 0.867 k Ω for the hog.

10 As shown in Fig. 1, the bar-shaped detecting unit 12 mounted with the electrodes 14 is attached to a body 38 containing the detecting circuit and the power battery.

The light emitting diodes DP1 to DP5 of the indicating
15 unit 20, and the operating switches 32 and 34 are arranged on the surface of the body 38.

Process of detecting the fertilizable period of the mammal by the fertilizability detecting apparatus embodying the
20 present invention will be described hereinafter.

First, the bar-shaped detecting unit 12 is inserted in the vagina of the mammal.

25 Then, the electrodes 14 provided on the extremity of the bar-shaped detecting unit 12 is pressed against the vaginal mucous membrane, and then the operating switch 34 is closed while the electrodes 14 are pressed against the vaginal mucous membrane.

30 Then, a voltage proportionate to the value of the impedance equivalent circuit 18A provided between the electrodes 14 is applied through the diode D1 to the respective noninverting terminals of the operational
35 amplifiers OP1 to OP6. On the other hand, divided voltages divided by the resistors R17 to R23 are applied respectively to the inverting input terminals of the operational amplifiers OP1 to OP6. The results of

1 comparison of the divided voltages applied respectively to
the operational amplifiers OP1 to OP6 with the voltage
proportionate to the impedance equivalent circuit 18A are
given to the exclusive OR circuits EOR1 to EOR5. The
5 divided voltages applied respectively to the inverting
terminals of the operational amplifiers OP1 to OP6
increase stepwise according to the resistances of the
resistors R23 to R17 in the order of the operational
amplifiers OP6 to OP1.

10 The exclusive OR circuits EOR1 to EOR5 perform the
function of the exclusive or respectively for the outputs
of the adjacent pairs of the operational amplifiers OP1 to
OP6. Consequently, one of the light emitting diodes DP1
15 to DP5 depending on the value of the impedance equivalent
circuit 18A.

As mentioned above, the sum of the resistances of the
voltage dividing resistors R18 to R23 is substantially
20 equal to the equivalent impedance of water and the sum of
the resistances of the voltage dividing resistors R19 to
R23 is equal to the equivalent impedance on the vaginal
mucous membrane in a condition suitable for introducing
the chilled semen into the uterus. Accordingly, the light
25 emitting diode DP1 lights up when the vaginal mucous
membrane is in a condition suitable for introducing the
frozen semen into the uterus. Similarly, the light
emitting diode DP2 lights up when the vaginal mucous
membrane is in a condition suitable for introducing the
30 chilled semen into the uterus.

When the impedance between the electrodes 14 is equal to
the equivalent impedance of water, the output signals of
the operational amplifiers OP1 and OP2 are applied to the
exclusive OR circuits EOR1, thereby the light emitting
35 diode DP1 is turned off.

Accordingly, the electrodes 14 are immersed in water to

- 1 check the fertilizability indicating apparatus.

Since the sum of the resistances of the voltage dividing resistors R21 to R23 is equal to the maximum impedance of
5 the impedance equivalent circuit 18A corresponding to that on the vaginal mucous membrane in the unfertilizable period where no ovulation occurs, the mammal is unfertilizable when the light emitting diode DP4 or DP5 lights up.

10 Since the light emitting diode DP4 represents a high-level impedance in the unfertilizable period and the light emitting diode DP5 represents a low-level impedance in the unfertilizable period, it is possible to decide if
15 ovulation is approaching and if ovulation has already occurred from the condition of the light emitting diodes DP4 and DP5 when the mammal is in the mating season. The light emitting diode DP3 indicates an intermediate period between the fertilizable period and the unfertilizable
20 period, namely, a so-called gray zone in which the fertilizability of the mammal is indefinite.

Since the resistance of the resistor R23 is slightly greater than the impedance of the objective mammal's
25 blood, the light emitting diode DP5 is turned off when the electrodes 14 are immersed in the objective mammal's blood.

Thus, the zero level of the fertilizability detecting
30 apparatus can be checked by immersing the electrodes 14 in the blood.

As is obvious from Fig. 4 showing a measured curve of the equivalent impedance on the hog's vaginal mucous membrane,
35 the equivalent impedance on the vaginal mucous membrane varies periodically with time between the zero point (the equivalent impedance of the blood) and 1 k along a stable curve during a period in which no ovulation occurs, starts

1 increasing from a moment forty-two to thirty-eight hours
before ovulation and approaches the equivalent impedance
of water infinitely, becomes substantially equal to the
equivalent impedance of water just before ovulation, and
5 then decreases sharply to a minimum in two to three hours
after reaching a maximum.

Ordinary the chilled semen is introduced into the vagina
about five to seven hours before ovulation for the
10 artificial insemination of the hog. Since the relation
between the equivalent impedance on the hog's vaginal
mucous membrane and time is constant, appropriate semen
introducing timing is achieved by constructing the
fertilizability detecting apparatus so that the light
15 emitting diode DP2 turns on seven to five hours before
ovulation.

When frozen semen is used, successful artificial
insemination can be achieved at a maximum conception rate
20 by depositing the frozen semen two hours before ovulation,
because a capsule (antigen, protoplasm and tunic) covering
a spermatozoon has been removed to capacitate the
spermatozoon for insemination and hence the frozen semen
is readily functioning for fertilization as compared with
25 the chilled or live semen. Accordingly, the frozen semen
is deposited when the light emitting diode DP1 lights up.
It is impossible to achieve fertilization when the frozen
semen is deposited when either one of the light emitting
diodes DP2 to DP5 is on.

30 Although the fertilizability detecting apparatus in this
embodiment detects the level of the impedance by the level
decision unit 18, the present invention is not limited
thereto in its application; any suitable impedance
35 detector may be used provided that the impedance detector
is able to detect the impedance or able to decide the
level of the impedance among a plurality of levels.

1 Although the indicating unit 20 of the foregoing
embodiment has the plurality of light emitting diodes DP1
to DP5, the present invention is not limited thereto in
its application; any suitable indicating means capable of
5 indicating values between the maximum impedance and the
minimum impedance of the impedance equivalent circuit 18A
of the vaginal mucous membrane may be employed.

Accordingly, the indicating unit 20 may be an ordinary
10 impedance meter 36 as shown in Fig. 5. In a second
embodiment employing such an impedance meter, equivalent
impedances between the maximum equivalent impedance
corresponding to that of water and the minimum equivalent
impedance corresponding to the blood, divided into
15 suitable levels can be indicated on the impedance meter,
and hence the level decision unit 18 can be substituted by
a single resistor. The second embodiment is capable of
detecting the ovulation period and unfertilizable period
more accurately than the first embodiment.

20 The number of the light emitting diodes need not be
limited to five, but may be two, three or not less than
six.

25 Furthermore, although the fertilizability detecting
apparatus in the foregoing embodiment detect the ovulation
period on the basis of the equivalent impedance on the
vaginal mucous membrane, the present invention is not
limited thereto in its application; any suitable detecting
30 means capable of directly or indirectly detecting the
sodium ion concentration on the vaginal mucous membrane
may be employed.

Accordingly, the sodium ion concentration on the vaginal
35 mucous membrane may be measured instead of the impedance.

Still further, although the present invention has been
described as applied to the detection of the

1 fertilizability of the hog, naturally, the present
invention is applicable to the detection of the
fertilizability of other mammals including men.

5 CAPABILITY OF EXPLOITATION IN INDUSTRY

The fertilizability detecting apparatus thus constructed
according to the present invention is capable of exactly
detecting the fertilizable period and unfertilizable
period of mammals.

10 The results of experimental application of the
fertilizability detecting apparatus of the present
invention to artificial insemination of hogs and cows
showed that the percentage of successful insemination is
15 100% excluding abnormal cases such as hogs and cows
suffering from endometritis, when the level decision unit
(the impedance detector) is set for a maximum value
substantially equal to the equivalent impedance of water
and for a minimum value substantially equal to the
20 equivalent impedance of the blood of the objective mammal.

25

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CLAIMS

1. A fertilizability detecting apparatus for mammals, comprising:
sodium ion concentration detecting means (10) for
5 detecting the sodium ion concentration on the mammal's vaginal mucous membrane; and
indicating means (20) for indicating a suitable inseminating period where a detected sodium ion concentration corresponds to a minimum sodium ion
10 concentration substantially equal to that of water, which is reached just before ovulation.
2. A fertilizability detecting apparatus for mammals according to claim 1, wherein said sodium ion
15 concentration detecting means (10) comprises:
a detecting unit (12) which is inserted in the mammal's vagina;
a plurality of electrodes (14) provided on the detecting unit (12) so as to be in contact with the vaginal mucous
20 membrane when the detecting unit (12) is inserted in the vagina;
a voltage generating means (16) for applying a voltage across the plurality of electrodes (12); and
an impedance detector (18) for detecting the impedance
25 between the electrodes; and
said indicating means (20) indicates a period just before ovulation suitable for depositing the semen in the uterus when a detected equivalent impedance on the vaginal mucous membrane detected by said impedance detector (18)
30 corresponds to an equivalent impedance on the vaginal mucous membrane before ovulation, on the basis of a maximum equivalent impedance between said electrodes on the vaginal mucous membrane substantially the same as that of water.
3. A fertilizability detecting apparatus for mammals, comprising:
sodium ion concentration detecting means (10) for

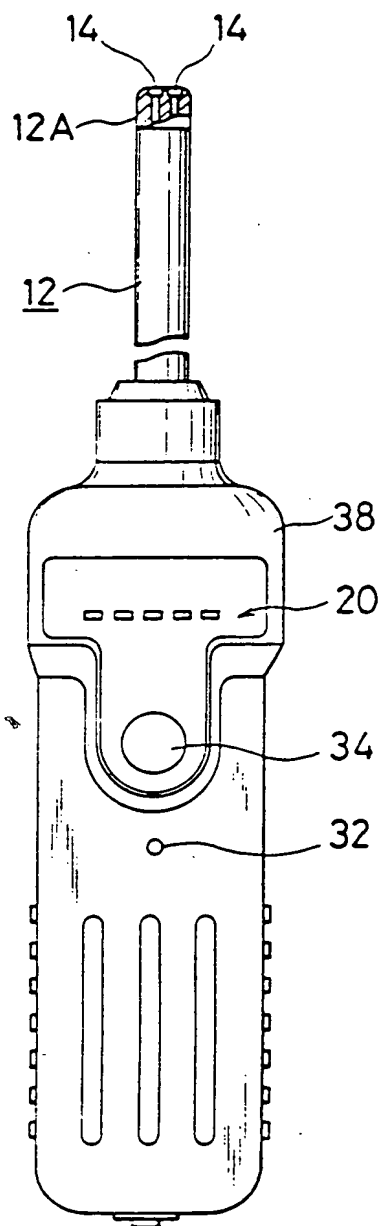
- 1 detecting the sodium ion concentration on the mammal's
vaginal mucous membrane; and
indicating means (20) for indicating an unfertilizable
period when a detected sodium ion concentration detected
5 by the sodium detecting means (10) corresponds to a
maximum sodium ion concentration substantially equal to
that of the mammal's blood which is reached during an
unfertilizable period in which no ovulation occurs.
- 10 4. A fertilizability detecting apparatus for mammals
according to claim 3, wherein said sodium ion
concentration detecting means (10) comprises:
a detecting unit (12) which is inserted in the mammal's
vagina;
15 a plurality of electrodes (14) provided on the detecting
unit (12) so as to be in contact with the vaginal mucous
membrane when the detecting unit is inserted in the
vagina;
a voltage generating means (16) for applying a voltage
20 across the plurality of electrodes (14); and
an impedance detector (18) for detecting the impedance
between the electrodes (14); and
said indicating means (20) indicates an unfertilizable
period where no ovulation occurs, when a detected
25 equivalent impedance on the vaginal mucous membrane
detected by said impedance detector (18) corresponds to a
minimum equivalent impedance substantially equal to that
of the mammal's blood representing an unfertilizable
period where no ovulation occurs.
- 30 5. A fertilizability detecting apparatus for mammals,
comprising:
sodium ion concentration detecting means (10) for
detecting the sodium ion concentration on the mammal's
35 vaginal mucous membrane; and
indicating means (20) for indicating an unfertilizable
period where no ovulation occurs, when a detected sodium
ion concentration detected by the sodium ion concentration

1 detecting means (10) corresponds to a sodium ion
concentration representing an unfertilizable period where
no ovulation occurs and determined on the basis of a
minimum sodium ion concentration just before ovulation
5 which is substantially equal to that of water, and a
maximum sodium ion concentration substantially equal to
that of the mammal's blood, representing an unfertilizable
period where no ovulation occurs.

10 6. A fertilizability detecting apparatus for mammals
according to claim 3, wherein said sodium ion
concentration detecting means (10) comprises:
a detecting unit (12) which is inserted in the mammal's
vagina;
15 a plurality of electrodes (14) provided on the detecting
unit (12) so as to be in contact with the vaginal mucous
membrane of the vaginal mucous membrane when the detecting
unit (12) is inserted in the vagina;
voltage generating means (16) for applying a voltage
20 across the plurality of electrodes (14); and
an impedance detector (18) for detecting the impedance
between the electrodes; and
said indicating means (20) indicates an unfertilizable
period where no ovulation occurs, when a detected
25 equivalent impedance on the vaginal mucous membrane
detected by said impedance detector (18) corresponds to an
equivalent impedance representing an unfertilizable period
where no ovulation occurs, determined on the basis of a
maximum equivalent impedance substantially equal to that
30 of water which is reached just before ovulation, and a
minimum equivalent impedance substantially equal to that
of the mammal's blood which is reached in a period where
no ovulation occurs.

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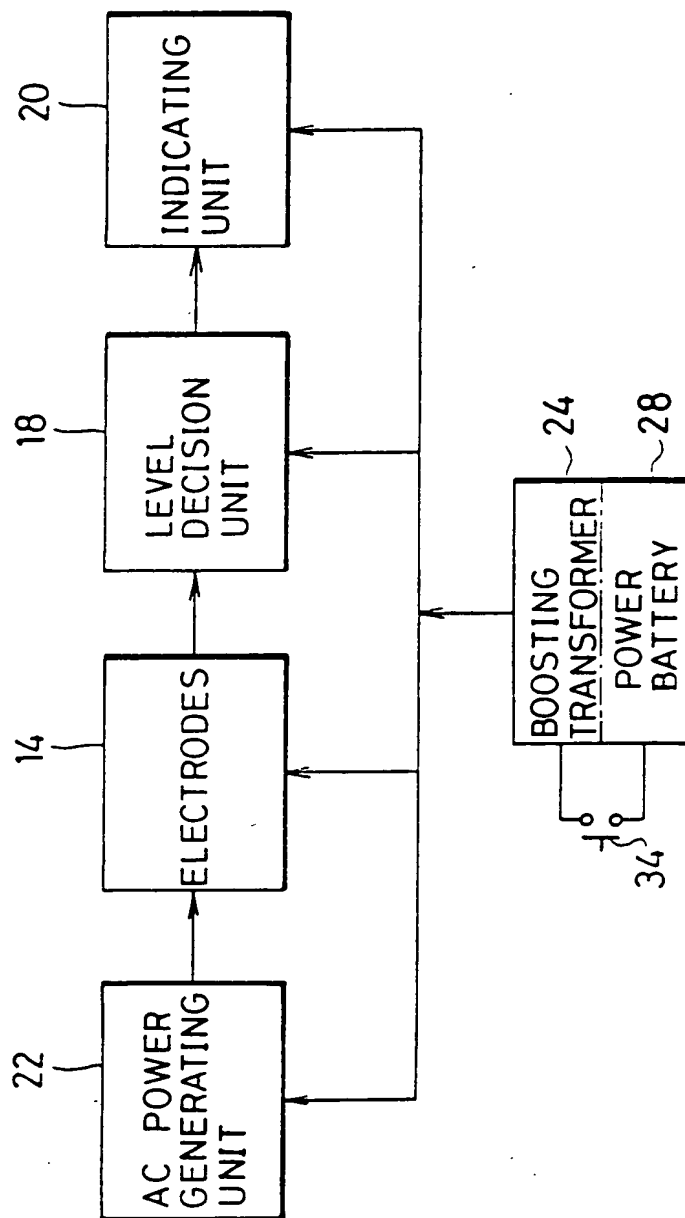
FIG. 1



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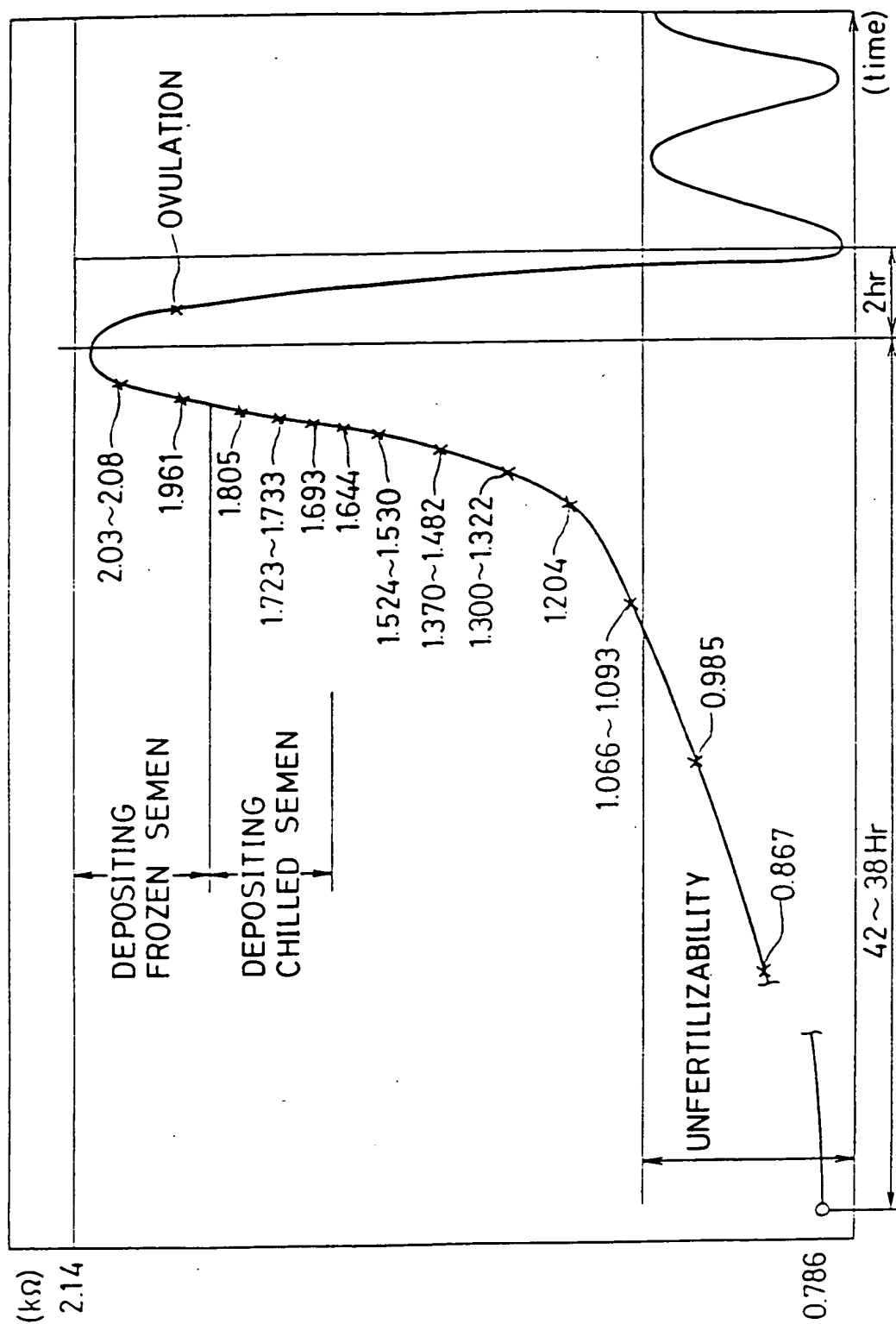
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FIG. 3



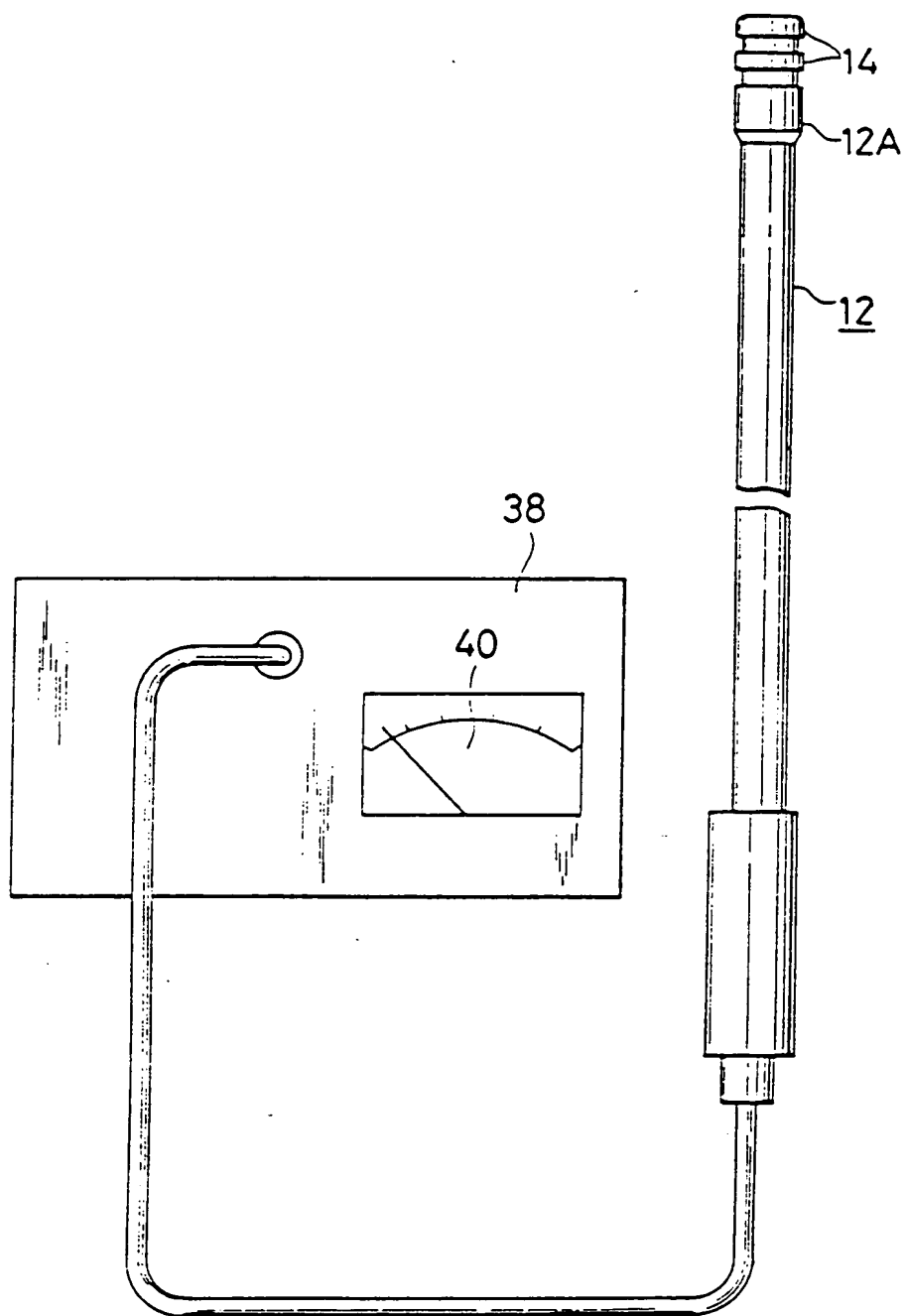
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FIG. 4



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FIG. 5



0 339 092

INTERNATIONAL SEARCH REPORT

International Application No.

PCT 339 092

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate All)

According to International Patent Classification (IPC) or to both National Classification and IPC

Int.C1⁴ A61B10/00, A61D1/08

II. FIELDS SEARCHED

Minimum Documentation Searched *

Classification System

Classification Symbols

IPC A61B10/00, A61D1/08

Documentation Searched other than Minimum Documentation
to the Extent that such Documents are included in the Fields Searched *Jitsuyo Shinan Koho 1960 - 1987
Kokai Jitsuyo Shinan Koho 1971 - 1987

III. DOCUMENTS CONSIDERED TO BE RELEVANT **

Category * Citation of Document, ** with indication, where appropriate, of the relevant passages ** Relevant to Claim No. **

X	JP, A, 61-113437 (Zetec Inc.) 31 May 1986 (31. 05. 86) Page 8, upper right column, line 10 to page 17, upper right column, line 7 (Family: none)	1-6
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"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents: such combination being obvious to a person skilled in the art

"G" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search *

March 1, 1988 (01. 03. 88)

Date of Mailing of this International Search Report *

March 14, 1988 (14. 03. 88)

International Searching Authority *

Japanese Patent Office

Signature of Authorized Officer **

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